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10/520,661	01/10/2005	Masahiko Hamanaka	Q85625	5612

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EXAMINER	
REDDING, THOMAS M	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/520,661	HAMANAKA, MASAHIKO	
	Examiner	Art Unit	
	THOMAS M. REDDING	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-57_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-57_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _10 January 2005_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _1/10/2005,3/27/2006, and 9/13/2006,_.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: Page 4, line 26, the operator is missing in the equation. Presumably the intended operation is multiplication.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

Claims 1-19 and 39-57 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 1-19, by invoking 35 USC 112 6th paragraph ("means for") are apparatus claims, and should be defining structure. However on page 51, the specification indicates that the functions of the components of the image matching system as recited by the claims may be implemented by software. Claims 39-57 define a computer program embodying functional descriptive material. However, the claims do not define a computer-readable medium or computer-readable memory and are thus non-statutory for that reason (i.e., “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized” – Guidelines Annex IV). The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests amending the claim(s) to embody the program on “computer-readable medium” or equivalent; assuming the specification does NOT define the computer readable medium as a “signal”, “carrier wave”, or “transmission medium” which are deemed non-statutory (refer to “note” below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

"A transitory, propagating signal … is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (*In re Petrus A.C.M. Nuijten;* Fed Cir, 2006-1371, 9/20/2007).

Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would be non-statutory. In the case where the specification defines the computer readable medium or memory as statutory tangible products such as a hard drive, ROM, RAM, etc, as well as a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests amending the claim to *include* the disclosed tangible computer readable media, while at the same time *excluding* the intangible media such as signals, carrier waves, etc.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1 – 57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

Some examples:

Claim 20 refers to matching against multiple reference images in line 5, and in line 9 refers to “the match between the reference image and the representative 3 dimensional object models”. It is not clear whether one or many reference images are intended. As best understood by the examiner at this time, the claim will interpreted as "the match between the reference images and the representative three-dimensional object models".

Claim 21 is ambiguous. It recites "a step of finding a reference three-dimensional object model associated with the reference image similar to the input image; and a step of newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image.", which seems to be a paraphrase of steps in the parent claim 20, “a step of making a match between the reference image(s) and a plurality of representative three-dimensional object models; and a step of retrieving the reference image similar to the input image by using a result of the match between the input image and the representative three-dimensional object models and a result of the match between the reference image and the representative three-dimensional object models”. An alternate interpretation is that claim 21 is

an attempt to describe an iteration step and the steps are in fact repeated. As best understood by the examiner at this time, the claim will be interpreted as describing iteration.

Claims 24, starting on line 9, recites "an image matching step of calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model". The intent of this claim is not at all clear. One possibility is that all that is intended is that a similarity score is calculated for each reference image in comparison with the input image and the best match is saved. Another possibility is that more than one measure of similarity is being calculated for each object model and only the best match is being recorded for each model; however there is no language in the claim actually supporting this view.

Claim 24 also intermixes preparatory steps among inspection steps which tends to confuse the interpretation. The two elements that deal with storing the 3D object models and storing the reference images are somewhat out of place. The element dealing with storing the reference images might make more sense if the projected 2D comparison images that were generated from the oriented 3D

models were being saved, but the term "reference image" links back to the reference images described in claim 20.

As currently best understood by the examiner, claim 24 will be read as:

The image matching method according to claim 20, comprising:

acquiring an input image;

storing generic 3d models in memory;

for each 3d model stored, generate a 2d comparison image in close to the same presentation as the input image;

calculate a similarity score between each comparison image and the input image, record the match with the highest score;

store reference images in memory;

for each of the stored reference images, compute similarities with each of the generic 3d models and record;

and

select a best matching reference image by comparing the similarities of the input image against the 3d models with the similarities of the reference images with the 3d models.

Claim 26 is punctuated with the phrase “every partial region” multiple times without a clear grammatical connection to the rest of the claim which makes the claim unintelligible.

Similar problems are present in many of the other claims and the whole claim list should be reviewed and rewritten to correct the problems.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 3, 4, 19, 22, 38, 39, 41 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy et al. (US 6,956,569) in combination with Nagao et al. (US 6,638,811).

Regarding claims 1, 20 and 39, Roy discloses [a]n image matching method for retrieving a reference image similar to an input image, the image matching method comprising:

a step of making a match between the input image and a plurality of representative three-dimensional object models ("matching a 2D image to one of a plurality of 3D candidate models contained in a database in which an object is identified", Roy, column 3, line 46);

a step of making a match between the reference image and the representative three-dimensional object models ("successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed representation of lighting effects; and comparing the two dimensional image with each of the rendered three dimensional candidate models", Roy, column 4, line 6).

Roy does not explicitly teach a step of retrieving the reference image similar to the input image by using a result of the match between the input image and the representative three-dimensional object models and a result of the match between the reference image and the representative three- dimensional object models.

Nagao, working in the same field of endeavor of face recognition, does teach a step of retrieving the reference image similar to the input image by using a result of the match between the input image and the representative three-dimensional object models and a result of the match between the reference image and the representative three-dimensional object models ("a display 17 for displaying a face image determined in the computer system 14 as a recognized result or a collated result; and an output terminal 18 for outputting the face image determined in the computer system 14", Nagao, column 14, line 19).

It would have been obvious at the time the invention was made, for one of ordinary skill in the art to combine the reference image display of Nagao with the face recognition system of Roy to permit an operator to further verify that the system has made a valid match.

Regarding claims 3, 22 and 41, the combination of Roy and Nagao teaches a step of finding a reference three-dimensional object model associated with the reference image similar to the input image (“matching a 2D image to one of a plurality of 3D candidate models contained in a database in which an object is identified”, Roy, column 3, line 46);

a conversion step of squaring an input condition of the input image with that of the reference image by converting the input image and/or the reference image on the basis of the reference three-dimensional object model (“successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed representation of lighting effects”, Roy, column 4, line 6); and

a step of retrieving the reference image associated with the input image by making a match between the input image and reference image squared in input condition (“comparing the two dimensional image with each of the rendered three dimensional candidate models”, Roy, column 4, line 10) .

Regarding claims 19, 38 and 57, the combination of Roy and Nagao teaches [t]he image matching method according to claim 20, wherein the object is a human face ("Although this invention is applicable to numerous and various types of objects to be recognized, it has been found particularly useful in the environment of human face recognition", Roy, column 5, line 15).

Claims 4, 23 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Roy and Nagao.

The combination of Roy and Nagao discloses substantially the claimed invention as set forth in the discussion above for claim 22.

The combination of Roy and Nagao does not disclose expressly pre-converting the reverence image and squaring the input image with the reference image.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to convert the input image. Applicant has not disclosed that converting the input image rather than the reference image provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with either converting the reference image or the input image.

Therefore, it would have been obvious to combine to one of ordinary skill in this art to modify the combination of Roy and Nagao to obtain the invention as specified in claims 4, 23 and 42.

6. Claims 2, 5, 9, 28, 24, 21, 40, 43 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy et al. (US 6,956,569) and Nagao et al. (US 6,638,811) in combination with Savakis et al. (US 6,847,733).

Regarding claims 2, 21 and 40 the combination of Roy and Nagao teaches the image matching method according to claim 20.

The combination of Roy and Nagao does not teach further comprising:

a step of finding a reference three-dimensional object model associated with the reference image similar to the input image; and

a step of newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image.

Savakis, working in a similar problem solving area of retrieving images from a database, does teach a step of finding a reference three-dimensional object model associated with the reference image similar to the input image; and

a step of newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image ("... provide selected images of highest emphasis or appeal 1228 back to the query processor 1222 to perform another database search", Savakis, column 15, line 64 and figure 13, Savakis

teaches the concept of using feedback to improve upon an image match within a database).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to combine the pattern matching feedback element of Savakis in the face recognition system of the combination of Roy and Nagao to find a better match by providing candidate reference images similar to the initial match ("The feedback feature 1228 can be used to provide a broader search/retrieval of the database 1200 by utilizing the highest emphasis and appeal images 1228 as the query instead of the single query image 1220", Savakis, column 15, line 66).

Regarding claims 5, 24 and 43, the combination of Roy, Nagao and Savakis teaches [t]he image matching method according to claim 20, comprising:

an image input step of inputting the input image ("a query photograph 50 is presented to the system for identification", Roy, column 10, line 34);

a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section ("Asynchronously, and over arbitrary lengths of time, the system is presented with 3D objects 10, typically human heads and preferably human faces, which it scans and digitizes with a scanning device 20, at the same time capturing the reflected light image at all included 3D data

points. A reflectance estimation module 30 computes a reflectance function for the 3D object 10. This information is then stored in a database 40", Roy, column 10, line 23);

an image generation step of generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three- dimensional object model storage section ("it obtains the next model 50 from the database 40, and obtains from a pose module 120 the pose solution for that model 10 and query image 50", Roy, column 10, line 45);

an image matching step of calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three- dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model ("The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50", Roy, column 10, line 43);

a step of storing the reference images of objects in a reference image storage

section ("... provide selected images of highest emphasis or appeal 1228 back to the query processor 1222 to perform another database search", Savakis, column 15, line 64 and figure 13, in order for Savakis to provide a reference image back to the query processor, the images must have been previously stored, figure 13, reference 1200);

a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section (“The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50”, Roy, column 10, line 43, in order to keep track of an earlier best match, there must be some provision for retaining the results); and

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section (“a display 17 for displaying a face image determined in the computer system 14 as a recognized result or a collated result; and an output terminal 18 for outputting the face image determined in the computer system 14”, Nagao, column 14, line 19).

Regarding claims 9, 28 and 47, the combination of Roy, Nagao and Savakis teaches [t]he image matching method according to claim 21, comprising:

an image input step of inputting the input image (“a query photograph 50 is presented to the system for identification”, Roy, column 10, line 34);

a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section (“Asynchronously, and

over arbitrary lengths of time, the system is presented with 3D objects 10, typically human heads and preferably human faces, which it scans and digitizes with a scanning device 20, at the same time capturing the reflected light image at all included 3D data points. A reflectance estimation module 30 computes a reflectance function for the 3D object 10. This information is then stored in a database 40", Roy, column 10, line 23);

an image generation step of generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three- dimensional object model storage section ("it obtains the next model 50 from the database 40, and obtains from a pose module 120 the pose solution for that model 10 and query image 50", Roy, column 10, line 45);

an image matching step of calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three- dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model ("The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50", Roy, column 10, line 43);

a step of storing the reference images of objects in a reference image storage

section ("... provide selected images of highest emphasis or appeal 1228 back to the query processor 1222 to perform another database search", Savakis, column 15, line 64 and figure 13, in order for Savakis to provide a reference image back to the

query processor, the images must have been previously stored, figure 13, reference 1200);

a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section ("The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50", Roy, column 10, line 43, in order to keep track of an earlier best match, there must be some provision for retaining the results);

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section ("a display 17 for displaying a face image determined in the computer system 14 as a recognized result or a collated result; and an output terminal 18 for outputting the face image determined in the computer system 14", Nagao, column 14, line 19);

a step of storing reference three-dimensional object models associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section ("Asynchronously, and over arbitrary lengths of time, the system is presented with 3D objects 10, typically human heads and

preferably human faces, which it scans and digitizes with a scanning device 20, at the same time capturing the reflected light image at all included 3D data points. A reflectance estimation module 30 computes a reflectance function for the 3D object 10. This information is then stored in a database 40", Roy, column 10, line 23);

a second image generation step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three-dimensional object model storage section, and generating at least one second comparison image close in input condition to the input image every reference three-dimensional object model on the basis of the obtained reference three-dimensional object models ("... provide selected images of highest emphasis or appeal 1228 back to the query processor 1222 to perform another database search", Savakis, column 15, line 64 and figure 13, in order for Savakis to provide a reference image back to the query processor, the images must have been previously stored, figure 13, reference 1200); and

a second image matching step of calculating similarities between the input image and second comparison images generated at the second image generation step, selecting a maximum similarity from among second comparison images associated with each of the reference three-dimensional object models, and regarding the maximum similarity as a similarity between the input image and the reference three-dimensional object model ("The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50", Roy, column 10, line 43).

Regarding claims 14, 33 and 52, the combination of Roy, Nagao and Savakis teaches [t]he image matching method according to claim 22, comprising:

an image input step of inputting the input image (“a query photograph 50 is presented to the system for identification”, Roy, column 10, line 34);

a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section (“Asynchronously, and over arbitrary lengths of time, the system is presented with 3D objects 10, typically human heads and preferably human faces, which it scans and digitizes with a scanning device 20, at the same time capturing the reflected light image at all included 3D data points. A reflectance estimation module 30 computes a reflectance function for the 3D object 10. This information is then stored in a database 40”, Roy, column 10, line 23);

an image generation step of generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three- dimensional object model storage section (“it obtains the next model 50 from the database 40, and obtains from a pose module 120 the pose solution for that model 10 and query image 50”, Roy, column 10, line 45);

an image matching step of calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three- dimensional object model, and regarding the maximum similarity

as a similarity between the input image and the representative three-dimensional object model (“The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50”, Roy, column 10, line 43);

a step of storing the reference images of objects in a reference image storage

section (“... provide selected images of highest emphasis or appeal 1228 back to the query processor 1222 to perform another database search”, Savakis, column 15, line 64 and figure 13, in order for Savakis to provide a reference image back to the query processor, the images must have been previously stored, figure 13, reference 1200);

a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section (“The lightsphere module 60 has a sub module 140 which sequentially considers one model 10 at a time for similarity to the query image 50”, Roy, column 10, line 43, in order to keep track of an earlier best match, there must be some provision for retaining the results);

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section (“a display 17 for displaying a face image determined in the computer system 14 as a recognized result or

a collated result; and an output terminal 18 for outputting the face image determined in the computer system 14”, Nagao, column 14, line 19)

a step of storing reference three-dimensional object models associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section (“Asynchronously, and over arbitrary lengths of time, the system is presented with 3D objects 10, typically human heads and preferably human faces, which it scans and digitizes with a scanning device 20, at the same time capturing the reflected light image at all included 3D data points. A reflectance estimation module 30 computes a reflectance function for the 3D object 10. This information is then stored in a database 40”, Roy, column 10, line 23);

an image conversion step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three- dimensional object model storage section, squaring an input condition of the input image with that of the reference image extracted at the result matching step by converting the input image and/or the reference image extracted at the result matching step, on the basis of the obtained reference three-dimensional object models, and generating partial images respectively of the input image and the reference image squared in input condition with each other (“determining the position and orientation of an object giving rise to the two dimensional image; computing a representation of lighting effects that allows the lighting that gave rise to the two dimensional image to be used to render a realistic image of a three dimensional model; successively rendering

each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed representation of lighting effects; and comparing the two dimensional image with each of the rendered three dimensional candidate models", Roy, column 4, line 2); and

a partial image matching step of calculating a similarity between the partial image of the input image and the partial image of the reference image generated at the image conversion step ("comparing the two dimensional image with each of the rendered three dimensional candidate models", Roy, column 4, line10).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS M. REDDING whose telephone number is (571)270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T. M. R./
Examiner, Art Unit 2624

/Vikkram Bali/
Supervisory Patent Examiner, Art Unit 2624